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ADTC-TR-73-21

TOPT (DDC)

Compatibility Test of Missile-Stores Mixed Loads on the Inboard Pylons of the F-4 Aircraft

(SEEK EAGLE)

TECHNICAL REPORT ADTC-TR-73-21

MAY 1973

3246TH TEST WING

ARMAMENT DEVELOPMENT AND TEST CENTER

AIR FORCE SYSTEMS COMMAND • UNITED STATES AIR FORCE

EGLIN AIR FORCE BASE, FLORIDA

COMPATIBILITY TEST OF MISSILE-STORES MIXED LOADS ON THE INBOARD PYLONS OF THE F-4 AIRCRAFT (SEEK EAGLE)

Charles M. Olive

FOREWORD

This test, Project 5221W046, was conducted in response to an Armament Development and Test Center (ADTC/DLGC) letter, "Effect of AIM-4 and AIM-9 Missiles on the Separation of Conventional Munitions," dated 18 April 1972. Testing began on 7 July 1972 and was completed on 5 February 1973.

ADTC personnel responsible for testing and report preparation were:

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Test Design Engineer	James M. Griffin
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This technical report is approved.

H. L. DIMMIG
Technical Director

WILLIAM A CLARK, Colonel, USAF
Commander

ABSTRACT

This test was conducted to determine which missile-stores combinations could be carried on the same inboard pylon of the F-4 aircraft. The selected munitions for which a fit test was performed included the MK 82 low drag general purpose bomb, MK 82 Snakeye, CBU-67B/B, MK 82 laser guided bomb, MK 84 laser guided bomb, MK 84 electro-optical guided bomb, M118 laser guided bomb, and the M118 electro-optical guided bomb. Of these munitions only the MK 82 low drag general purpose bomb, the MK 82 Snakeye, and the CBU-67B/B fit when they were loaded on an inboard TER station and an AIM-4D was mounted on the inboard side of the pylon. For these three munitions, store separation testing was also accomplished (the CBU-67B/B was replaced by the CBU-67H/B for separation testing). The presence of an AIM-4D on the pylon tended to increase nose-down pitch of these munitions when compared to releases of the munitions without an AIM-4D mounted on the pylon.

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CONTENTS

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SECTION I

INTRODUCTION

This test is part of a program to establish a capability to carry missiles and other munitions simultaneously on the same F-4 aircraft pylon. This test consisted of fit tests and flight tests to provide AFATL (DLGC) with data for making certification recommendations of the selected munitions in the presence of missiles on the inboard stations of the F-4 aircraft.

The specific objectives of testing were:

1. Determine the physical compatibility of the selected munitions with the AIM-4D or AIM-9B/E on the inboard stations of the F-4 aircraft.

2. Gather comparative separation data of the MK 82 low drag general purpose bomb, the MK 82 Snakeye, and the CBU-67H/B released from the inboard TER stations of the F-4 aircraft, with and without the AIM-4D missile mounted on the same pylon.

Both of the objectives were accomplished.

SECTION II

DESCRIPTION

The selected munitions and missiles for this test were as follows:

1. MK 82 low drag general purpose (LDGP) bomb - 500-pound bomb with MAU-93/B fin.

2. MK 82 Snakeye (SE) - 500-pound bomb with MK 15 Mod 3 fin.

3. CBU-67 - 800-pound cluster bomb representative of SUU-30 munitions.

a. CBU-67B/B - consists of the SUU-30B/B filled with BLU-26/B (inert) submunitions; used for fit testing only.

b. CBU-67H/B - consists of the SUU-30H/B filled with BLU-26/B (inert) submunitions; used for separation testing only.

4. MK 82 laser guided bomb (LGB) - 500-pound bomb with the KMU-388/B guidance kit.

5. MK 84 LGB - 2,000-pound bomb with the KMU-351/B guidance kit.

6. MK 84 electro-optical guided bomb (EO) - 2,000-pound bomb with the KMU-353/B guidance kit.

7. M118 LGB - 3,000-pound bomb with the KMU-370/B guidance kit.

8. M118 EO - 3,000-pound bomb with the KMU-390/B guidance kit.

9. AIM-4D - Falcon missile.

10. AIM-9B/E - Sidewinder missile.

All of the munitions mentioned above are described more fully in Technical Order 1F-4C-33-1-1.

SECTION III

TEST PROCEDURES AND RESULTS

GROUND FIT TESTS

Three fit tests were performed. For the first fit test, the L-41 launcher and the AIM-4D were mounted on the inboard side of the left inboard pylon. Then an attempt was made to load each of the following munitions on the inboard station of a TER: MK 82 LDGP, MK 82 SE, CBU-67B/B, and MK 82 LGB (27-inch fin span). The MK 82 LDGP fit easily (Figure 1). The MK 82 LGB did not fit due to major physical interference (4 inches). The MK 82 SE and the CBU-67B/B did fit, but with the minimum clearances established as a guideline by MIL-STD-1289 (1 inch between adjacent stores). See Figures 2 and 3.

For the second fit test, the AERO-3B launcher (launcher for the AIM-9 Sidewinder) with 3-inch extenders was mounted on the inboard side of the left inboard pylon. An attempt to load the MK 82 LGB (27-inch fin span) proved that it would not fit.

For the third fit test, the L-41 launcher and the AIM-4D were mounted on the inboard side of the left inboard pylon similar to the first fit test. An attempt was made to load each of the following munitions directly onto the pylon: MK 82 LGB (27-inch fin span), M118 LGB, M118 EO, MK 84 EO, MK 84 LGB (54-inch fin span). None of these munitions would fit except for the MK 84 LGB. However, the MK 84 LGB tail fin would be in the direct blast area of the AIM-4D motor (Figure 4) and the forward canard would be in the path of the missile should it be launched.

Table I gives the results of the three fit tests.

SEPARATION TESTS

For the separation portion of the test, four missions were required as follows:

Munition	Desired condition
MK 82 LDGP	550 KCAS/0°/5,000 ft
MK 82 Snakeye	500 KCAS/0°/5,000 ft
CBU-67H/B	475 KCAS/0°/5,000 ft
CBU-67H/B	550 KCAS/0°/5,000 ft

For each mission an AIM-4D and launcher were mounted on the inboard side of the right inboard pylon and six munitions were loaded onto TERs on left and right inboard pylons. The left inboard TER had a modified release sequence, 1-3-2 instead of 1-2-3, so that a comparison could be made between releases from the left with clean pylon and from the right with an AIM-4D and launcher mounted on the pylon (Figure 5).

In order to obtain photogrammetric data, a Type IV camera pod was mounted on station 1 of a centerline MER shifted forward. Also, munitions had to be painted with a photogrammetric pattern, ADTC (TSG) drawing number 71XAD473C, and decals applied to the inboard pylons according to ADTC (TSG) drawing number 71XAD472C.

A study of the film coverage and of the reduced photogrammetric data indicated that the nose of all munitions released from the right inboard pylon, in the presence of the AIM-4D and launcher, pitched down more than the nose of corresponding munitions released from the left inboard pylon. No predictable effect on yaw could be attributed to the presence of the AIM-4D and launcher on the right inboard pylon.

Table II summarizes the results of the four separation tests.

The results of the photogrammetric data reduction are given in Appendix I. The corresponding weight, center of gravity, and moments of inertia for the munitions are given in Appendix II.

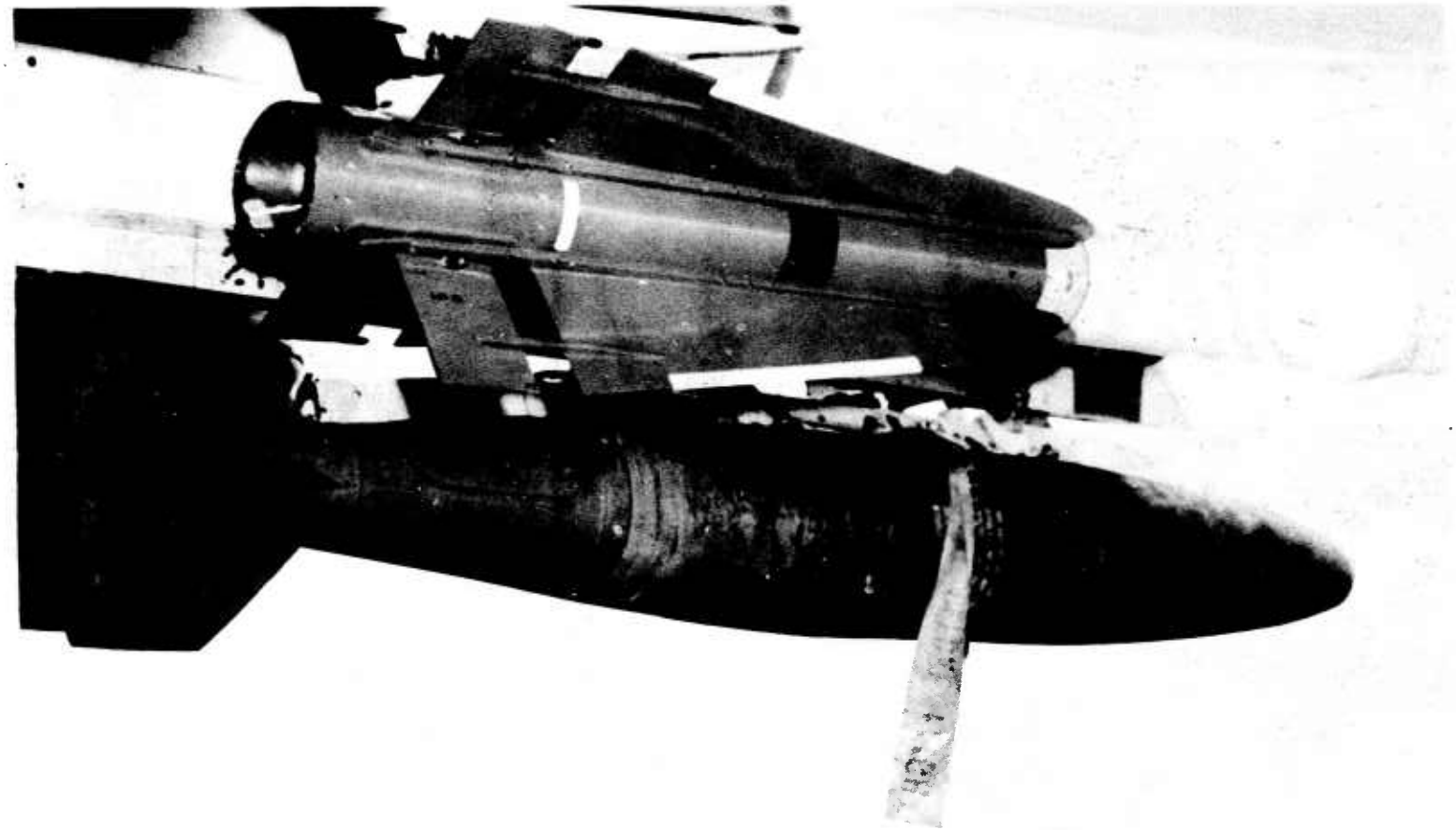


Figure 1. AIM-4D missile and MK 82 LDGP on shoulder TER station

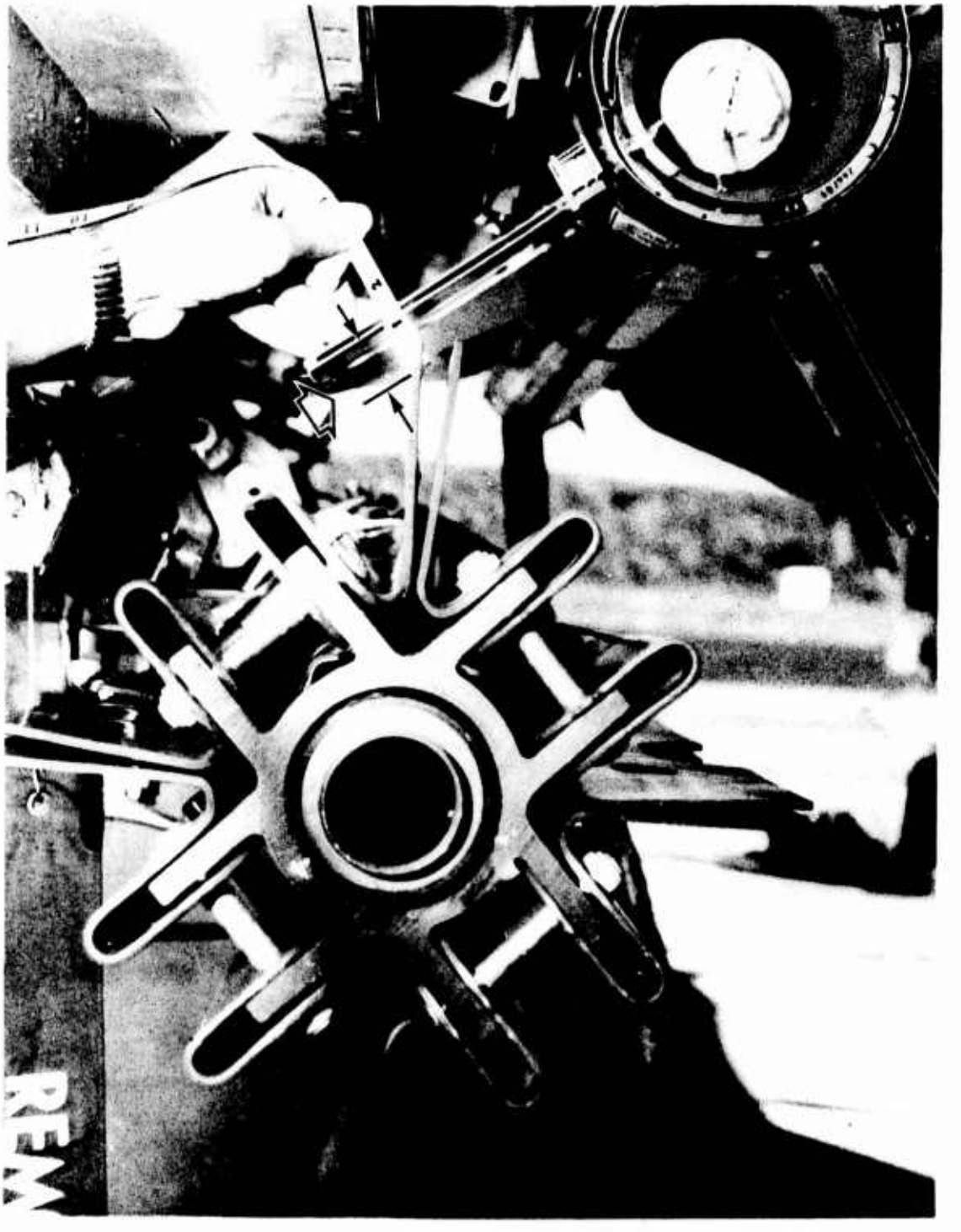


Figure 2. AIM-4D missile and MK 82 Snakeye on shoulder TER station with minimum missile-to-store clearance of 1 1/4 inches (arrow)

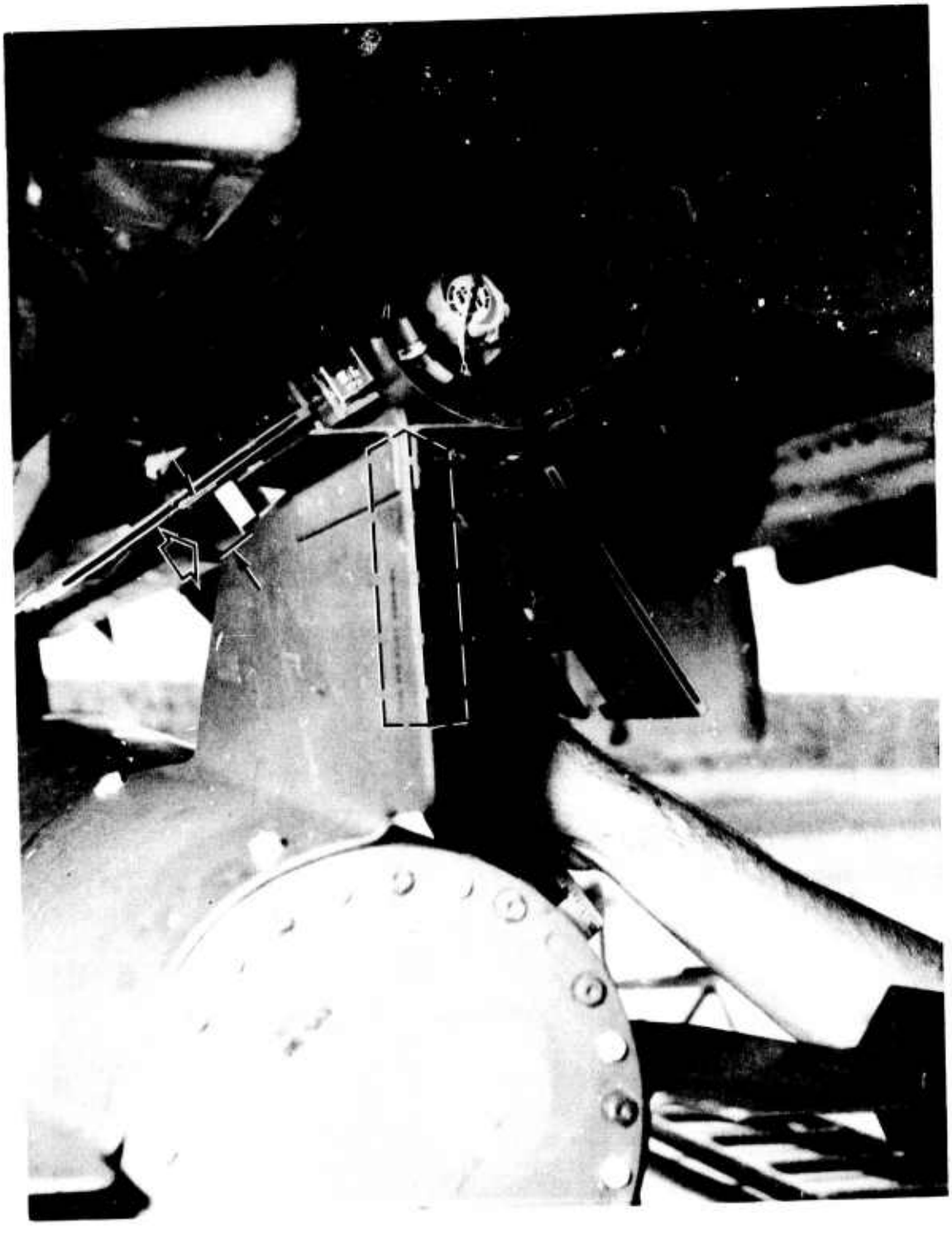


Figure 3. AIM-4D missile and CBU-67B/B on shoulder TER station with minimum missile-to-store clearance of 1 1/8 inches (arrow). Dotted lines show position of fin tabs on fins of CBU-67H/B

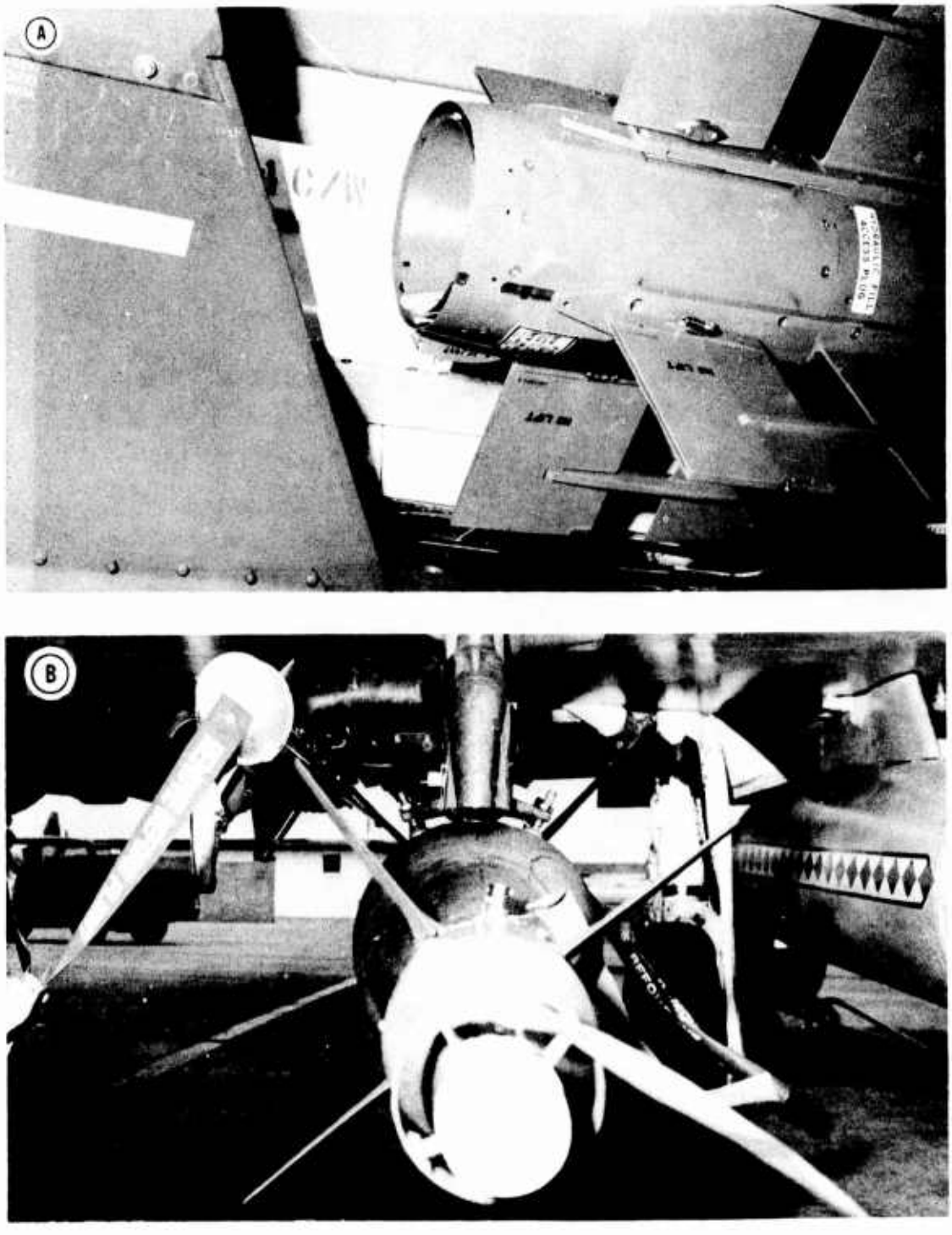


Figure 4. MK 84 LGB fin in the direct blast area of the AIM-4D motor (A) and MK 84 LGB canard in the path of the AIM-4D (B)

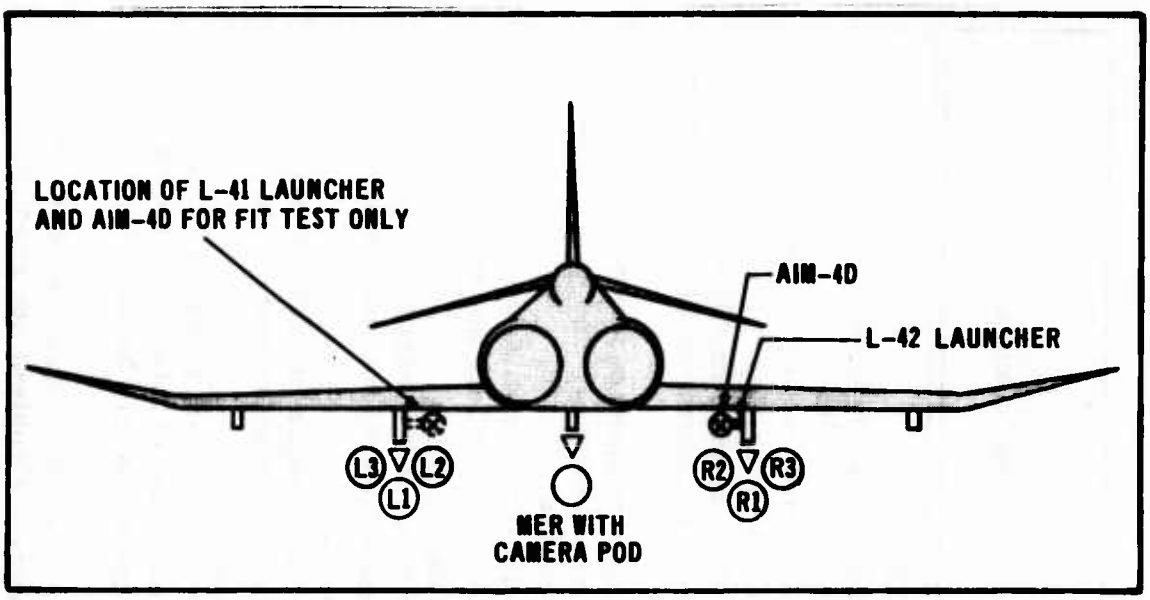


Figure 5. Aircraft configuration (aft view) showing TER with modified release sequence on left inboard pylon, AIM-4D and launcher on inboard side of right inboard pylon, and standard TER on right inboard pylon. Note that pair releases will produce the pairs L1 and R1, L2 and R2, and L3 and R3

Table I. Fit test of selected stores/missiles

Date (1972)	Loading configuration			Fit test comments
	Inbd side of LIB pylon	Inbd TER sta	Directly to pylon	
25 Aug	AIM-4D	MK 82 LDGP	---	Fit test OK.
25 Aug	AIM-4D	MK 82 SE	---	Fit test OK - minimum missile-to-store clearance 1 1/4 inches.
25 Aug	AIM-4D	CBU-67	---	Fit test OK - minimum missile-to-store clearance 1 1/8 inches.
25 Aug	AIM-4D	MK 82 LGB	---	Does not fit - major missile-to-store interference. Problem not readily correctable.
31 Aug	AIM-9B/E	---	MK 82 LGB	Does not fit - major launcher (AERO-3B) to store interference. Problem not readily correctable.
31 Oct	AIM-4D	---	MK 82 LGB	Does not fit - major missile-to-store interference. Problem not readily correctable.
31 Oct	AIM-4D	---	M118 EO	Does not fit - major missile-to-store interference. Problem not readily correctable.
31 Oct	AIM-4D	---	M118 LGB	Does not fit - major missile-to-store interference. Problem not readily correctable.
31 Oct	AIM-4D	---	MK 84 LGB	Adequate clearances; however, tail fin is in direct blast of AIM-4D motor and forward canard would be in path of missile.
31 Oct	AIM-4D	---	MK 84 EO	Does not fit - major missile-to-store interference. Problem not readily correctable.

Table II. Separation test of selected stores/missiles

Date (1973)	Loading configuration				Pair[b] release number	Release conditions				Comments[e]
	TER[a] on LIB pylon	Centerline MER	TER on RIB pylon	Inboard side of RIB pylon		Airspeed (KCAS)	Altitude (ft)	Dive angle (deg)	G loading	
16 Jan	3 MK 82 LDGP	Type IV camera pod	3 MK 82 LDGP	L-42 launcher and AIM-4D	1	550	5,020	0	1	Store from RIB pitched down more than store from LIB.
					2	550	5,020	0	1	
					3	550	5,020	0	1	
22 Jan	3 MK 82 SE	Type IV camera pod	3 MK 82 SE	L-42 launcher and AIM-4D	1	515	5,250	0	1	Store from RIB pitched down more than store from LIB.
					2	515	5,250	0	1	
					3	515	5,250	0	1	
24 Jan	3 CBU-67H/B	Type IV camera pod	3 CBU-67H/B	L-42 launcher and AIM-4D	1[c]	475	5,000	0	1	Store from RIB pitched down more than store from LIB.
					2	475	5,000	0	1	
					3	475	5,000	0	1	
29 Jan/ 5 Feb	3 CBU-67H/B	Type IV camera pod	3 CBU-67H/B	L-42 launcher and AIM-4D	1[d,e]	550/540	5,000	0	1	Store from RIB pitched down more than store from LIB.
					2[e]	550/540	5,000	0	1	
					3	540	5,000	0	1	

[a] LIB TER has modified release sequence (1-3-2 instead of 1-2-3).
[b] Munitions were released in pairs. Pair 1 is LIB TER station 1 and RIB TER station 1; pair 2 is LIB TER station 3 and RIB TER station 2; pair 3 is LIB TER station 2 and RIB TER station 3.
[c] The tail of both CBU-67H/B pitched up and struck the remaining stores.
[d] Due to aircraft malfunction, these releases were not pair releases. First two releases from the LIB TER were on 29 Jan at 550 KCAS.
[e] Any differences in separation which can be attributed to the presence of the AIM-4D and launcher on the RIB pylon.

SECTION IV

SUMMARY OF FINDINGS

1. Only the MK 82 LDGP, MK 82 Snakeye, and the CBU-67B/B on the inboard TER stations of the F-4 aircraft were compatible with an AIM-4D and launcher mounted on the inboard side of an inboard pylon.

Of the stores investigated, none were physically compatible with the AERO-3B (launcher for the AIM-9B/E).

2. Although no unsafe separation characteristics were noted, separation tests indicated that the presence of the AIM-4D and launcher on the inboard side of an inboard pylon caused increased nose-down pitch of the MK 82 LDGP, MK 82 Snakeye, and the CBU-67H/B when released from that pylon.

APPENDIX I

RESULTS OF PHOTOGRAMMETRIC DATA REDUCTION

Figures I-1 through I-4 are plots of pitch versus displacement and yaw versus displacement. The F-4 schematic above the plots indicates the pair of munitions to which the plots apply.

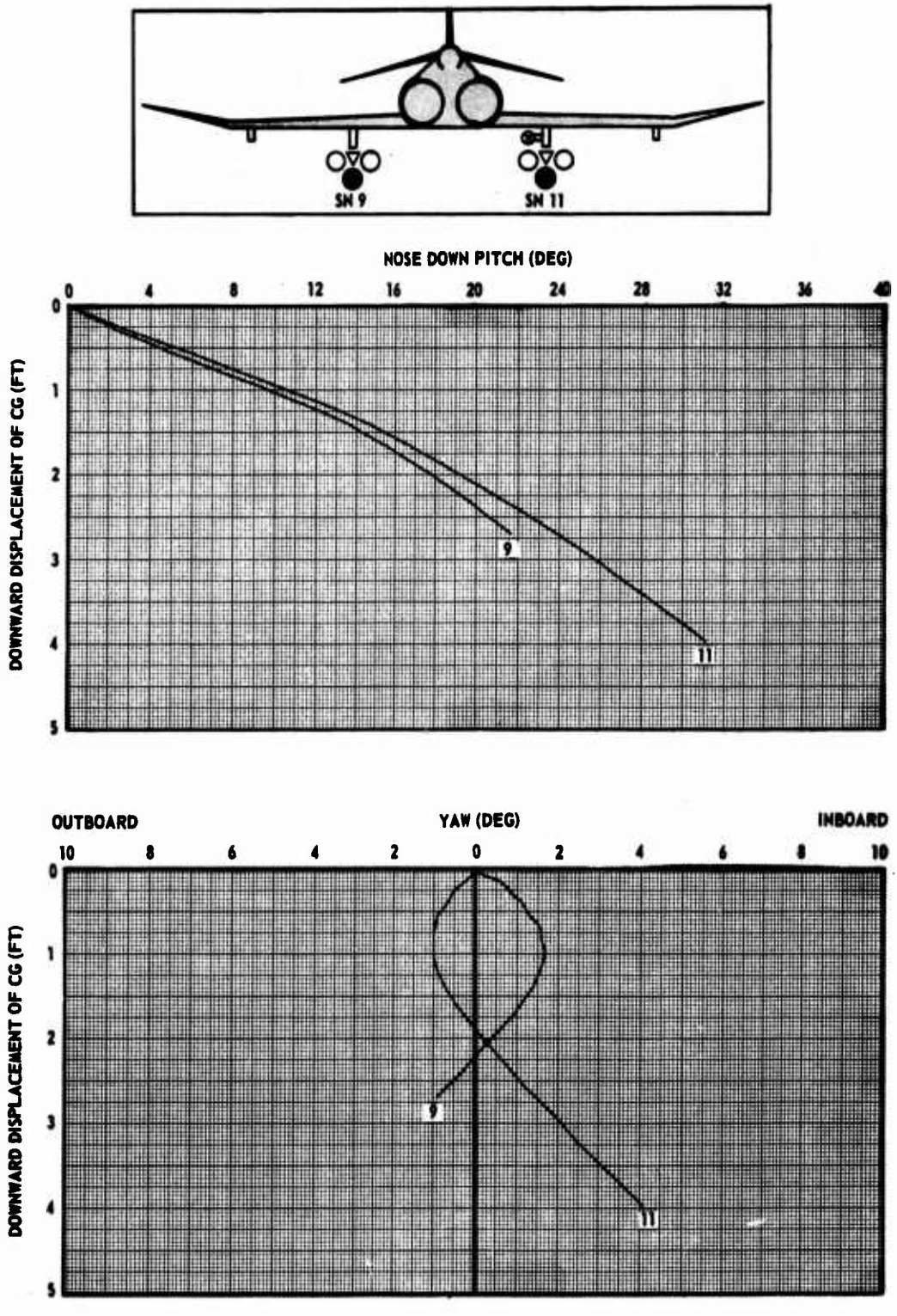
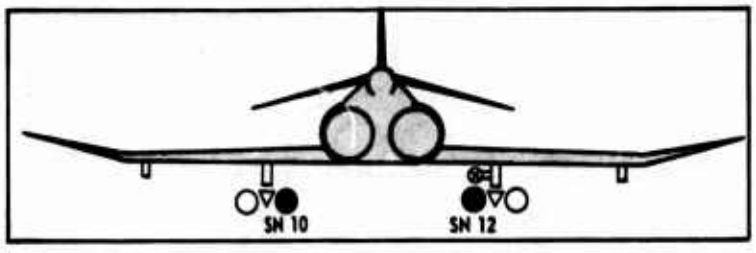
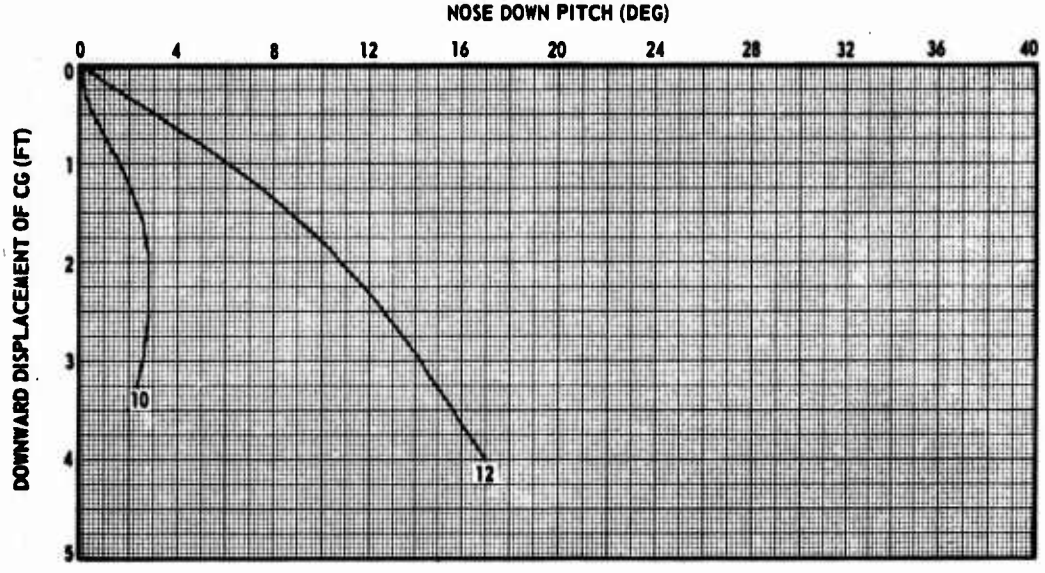


Figure I-1. Separation characteristics of MK 82 LDGP at 550 KCAS





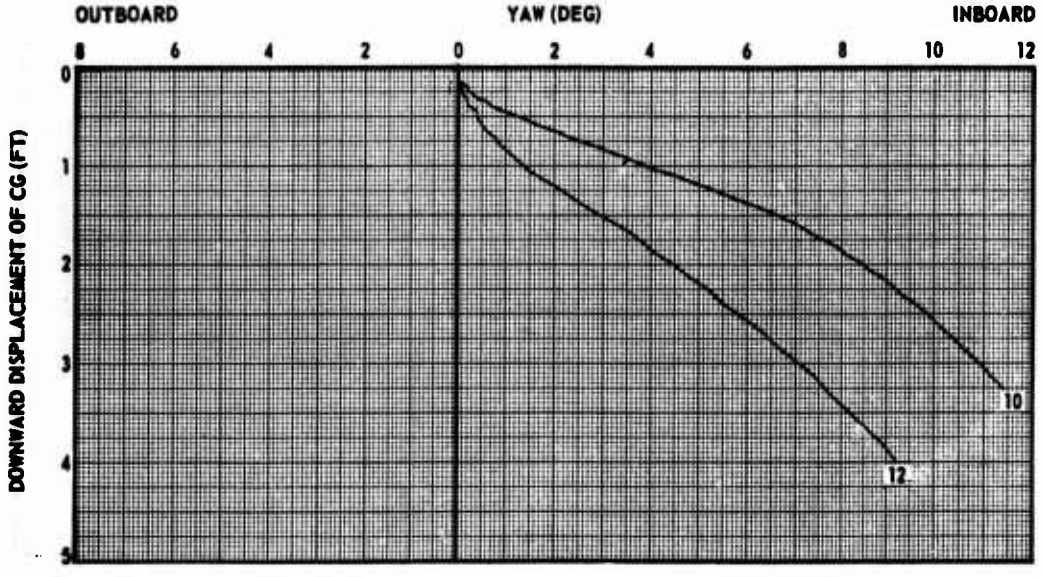
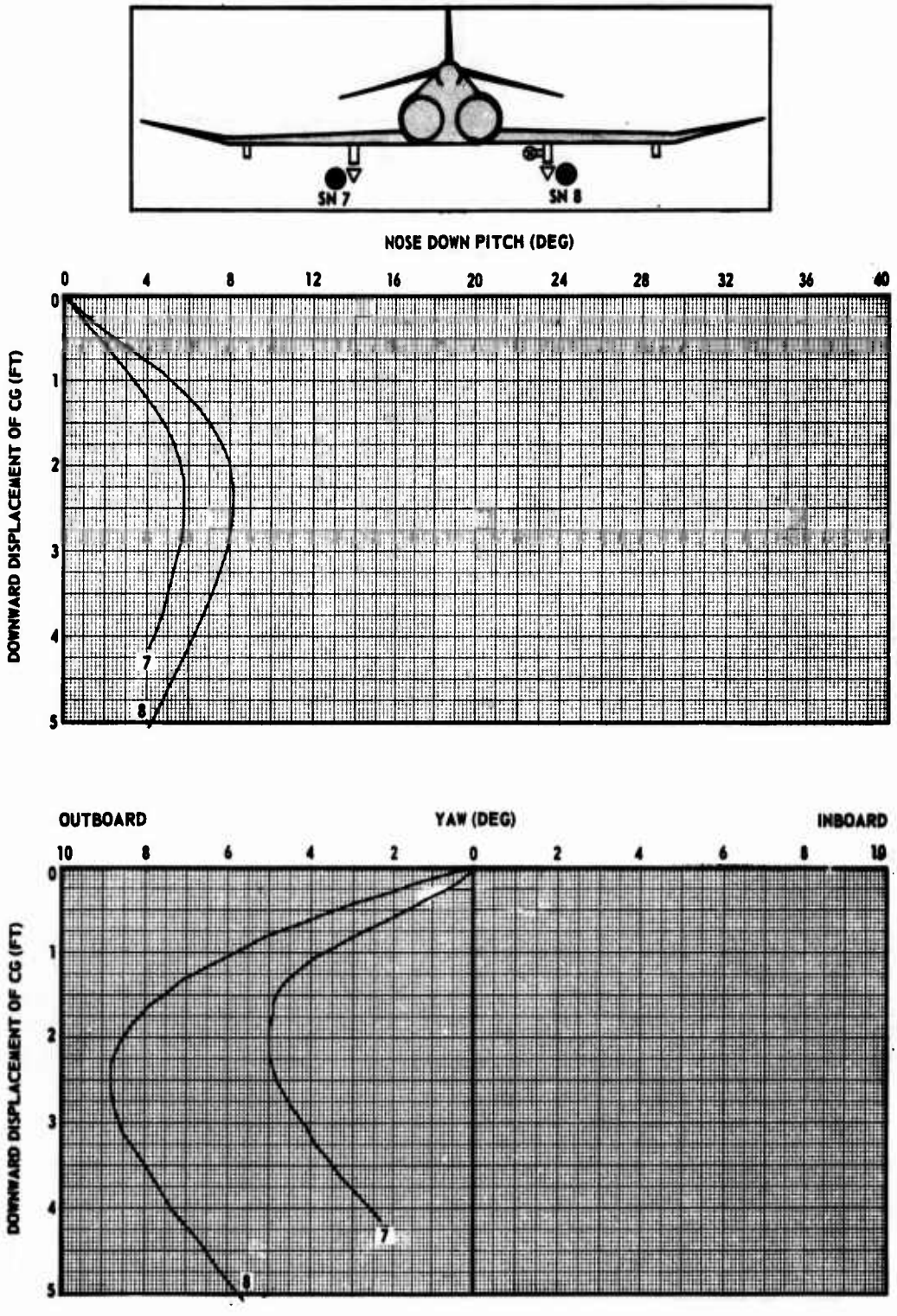


Figure I-1. (Continued)



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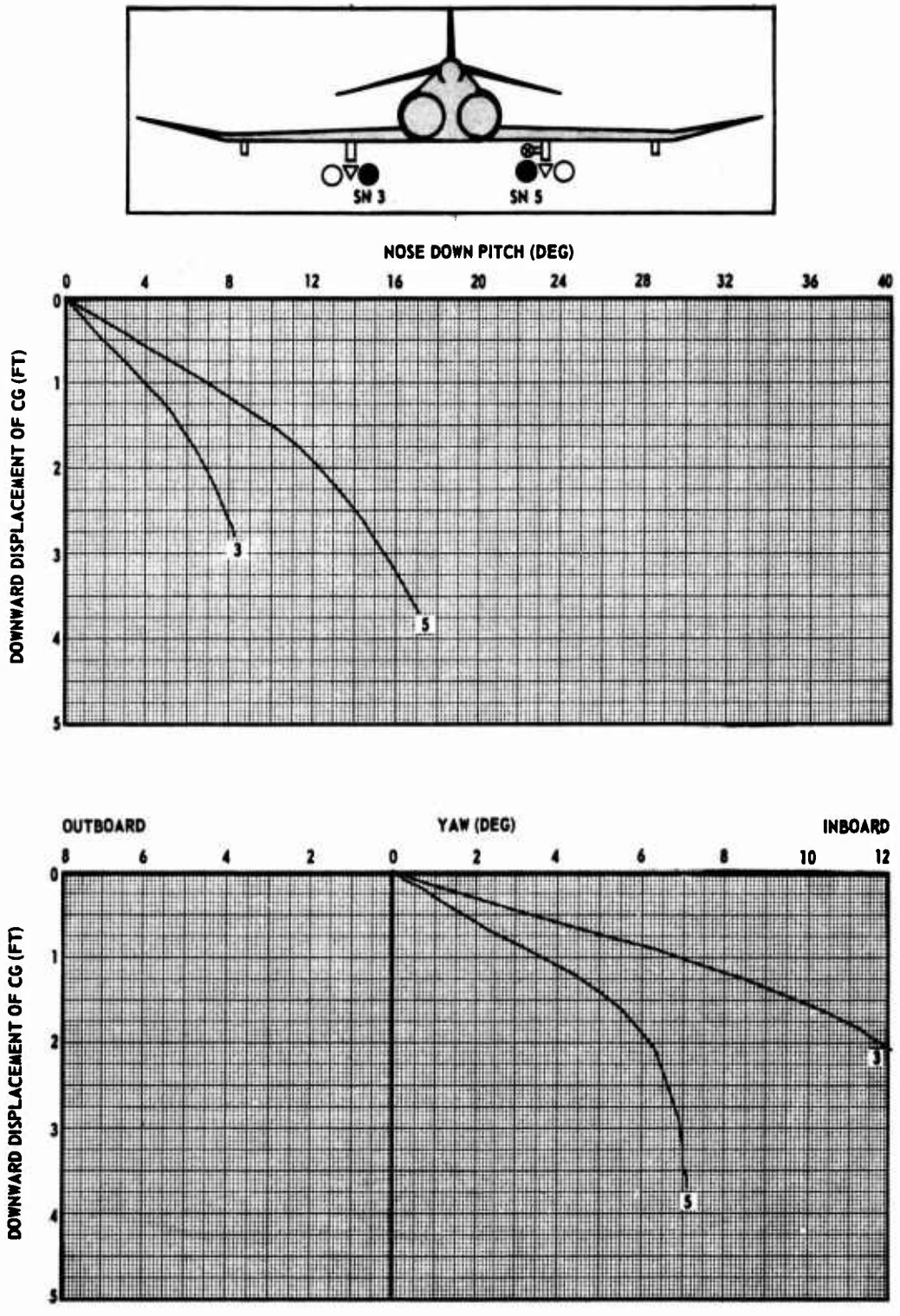

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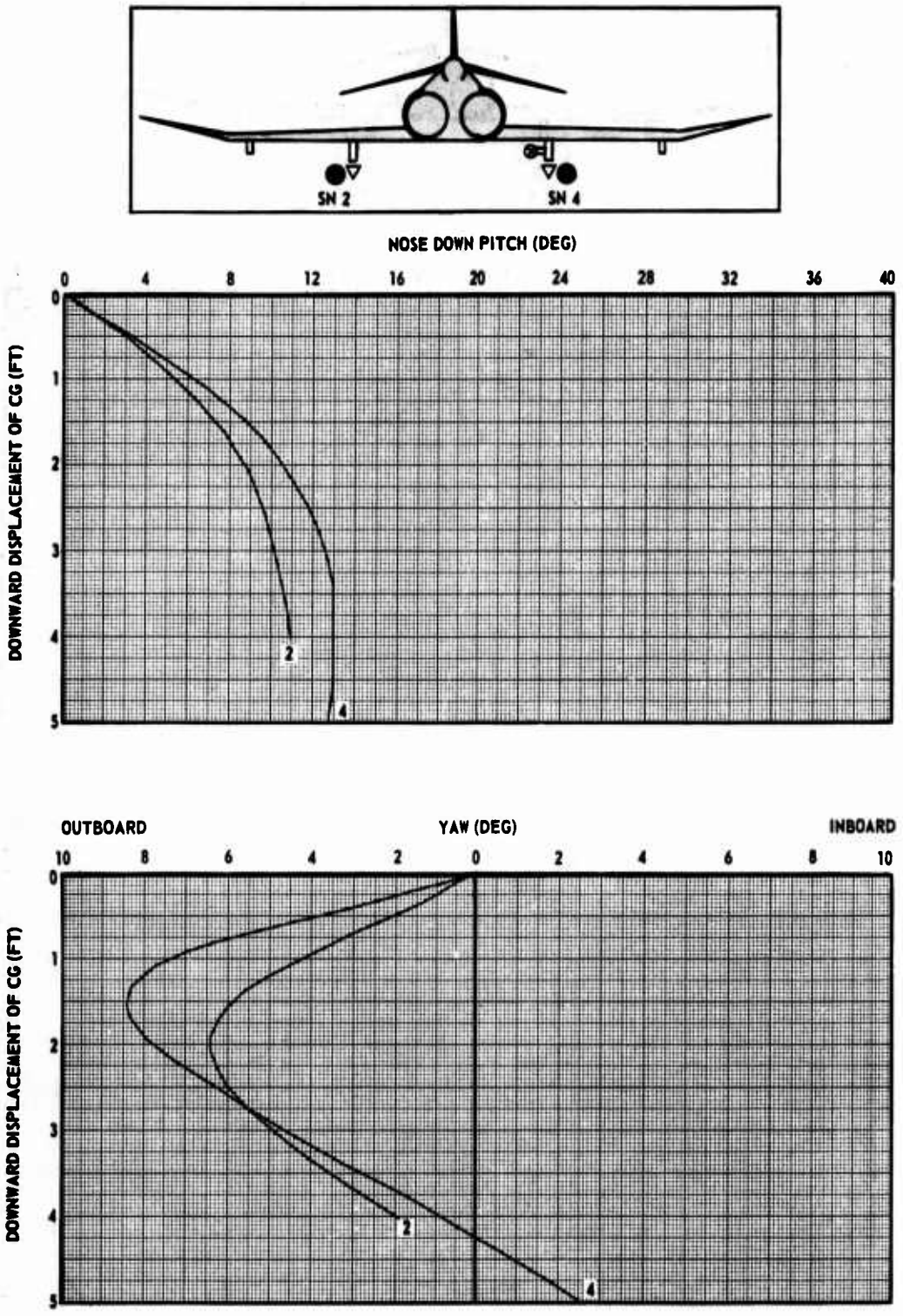

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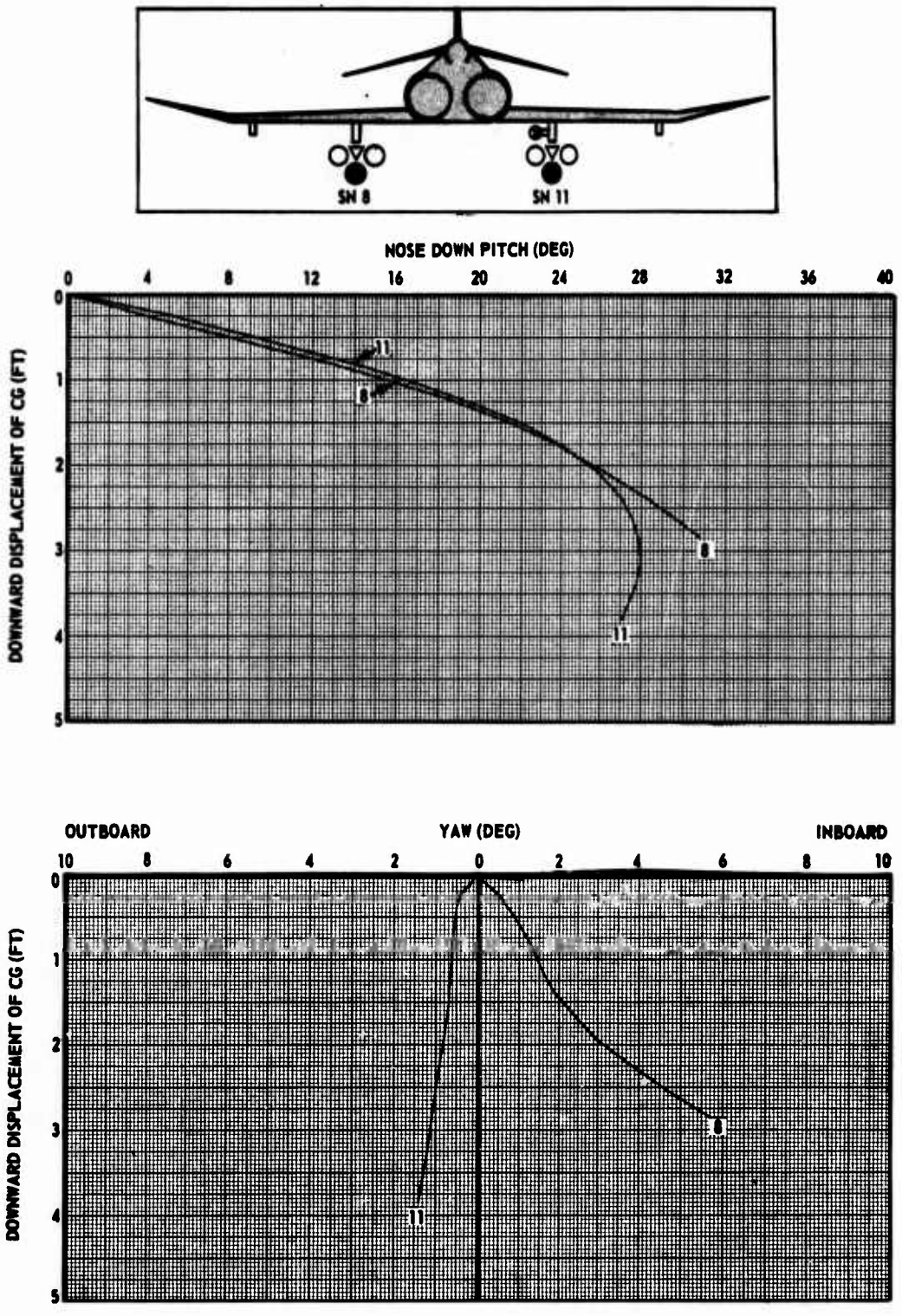
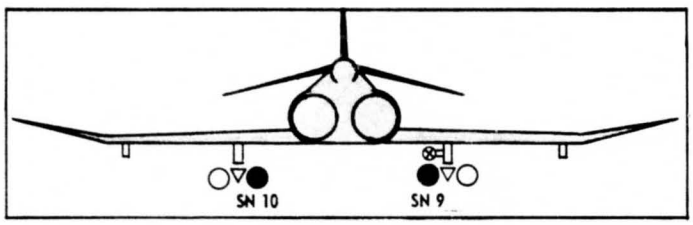
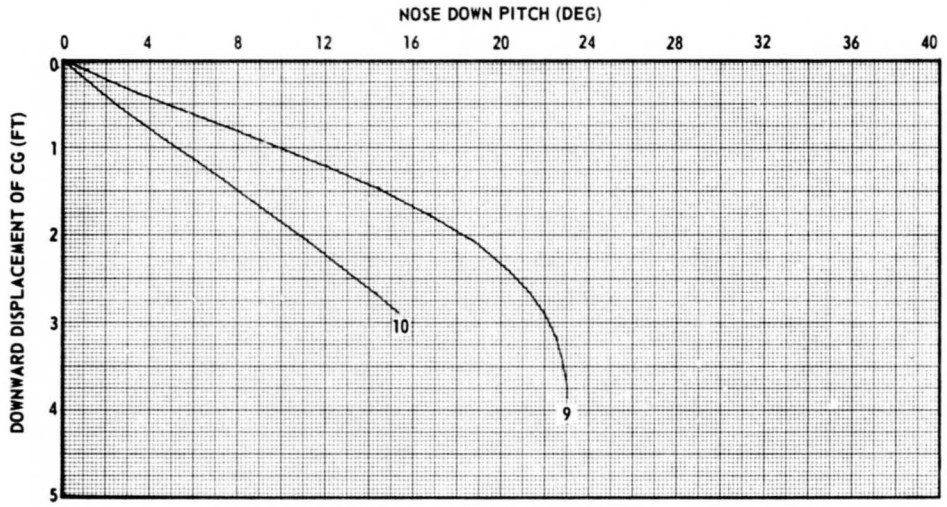
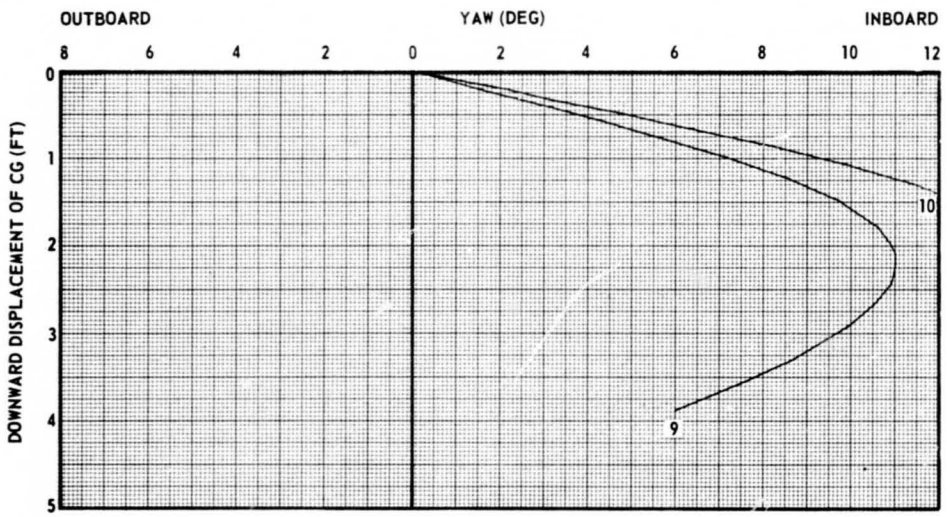


Figure I-3. Separation characteristics of CBU-67H/B at 475 KCAS







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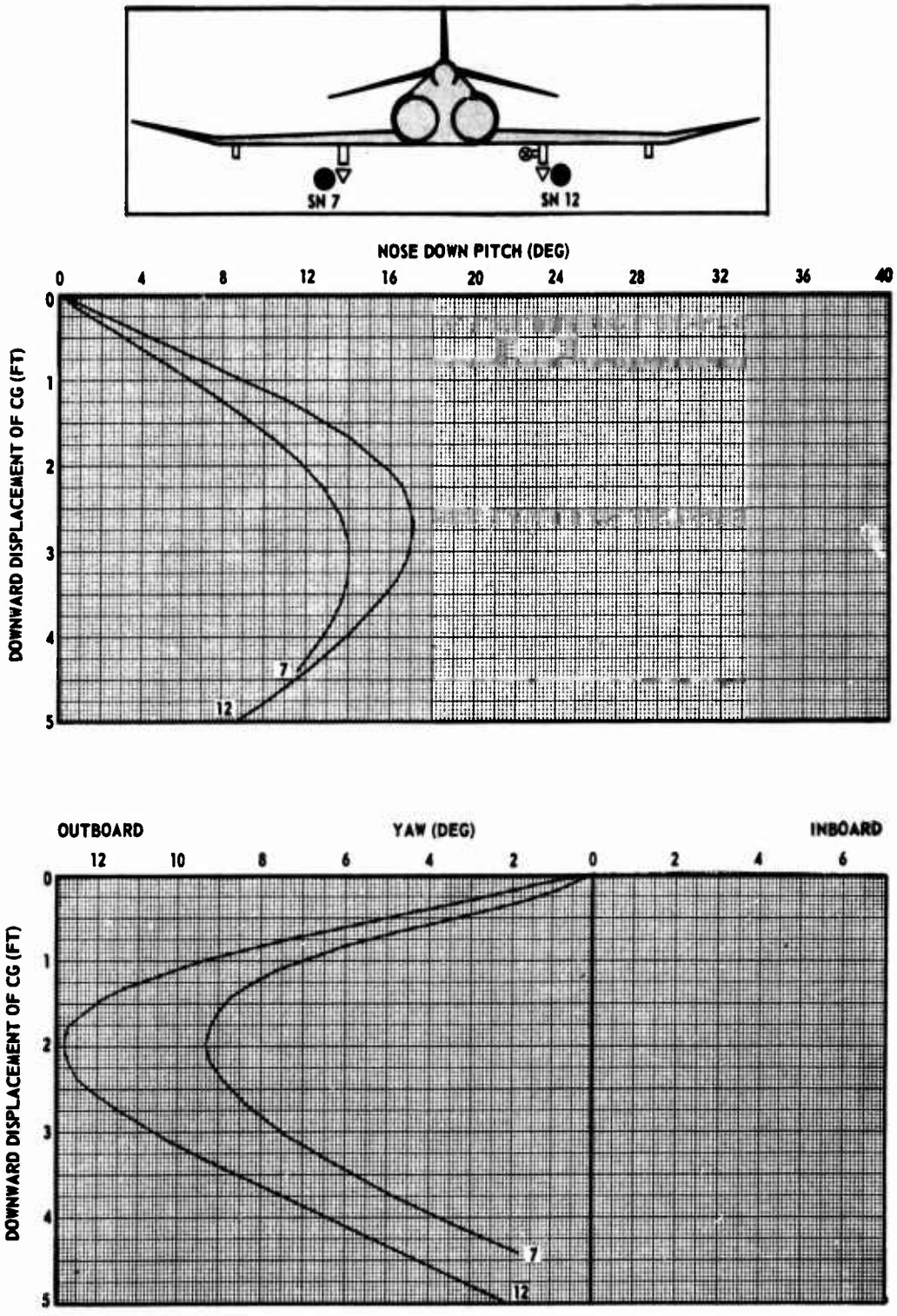

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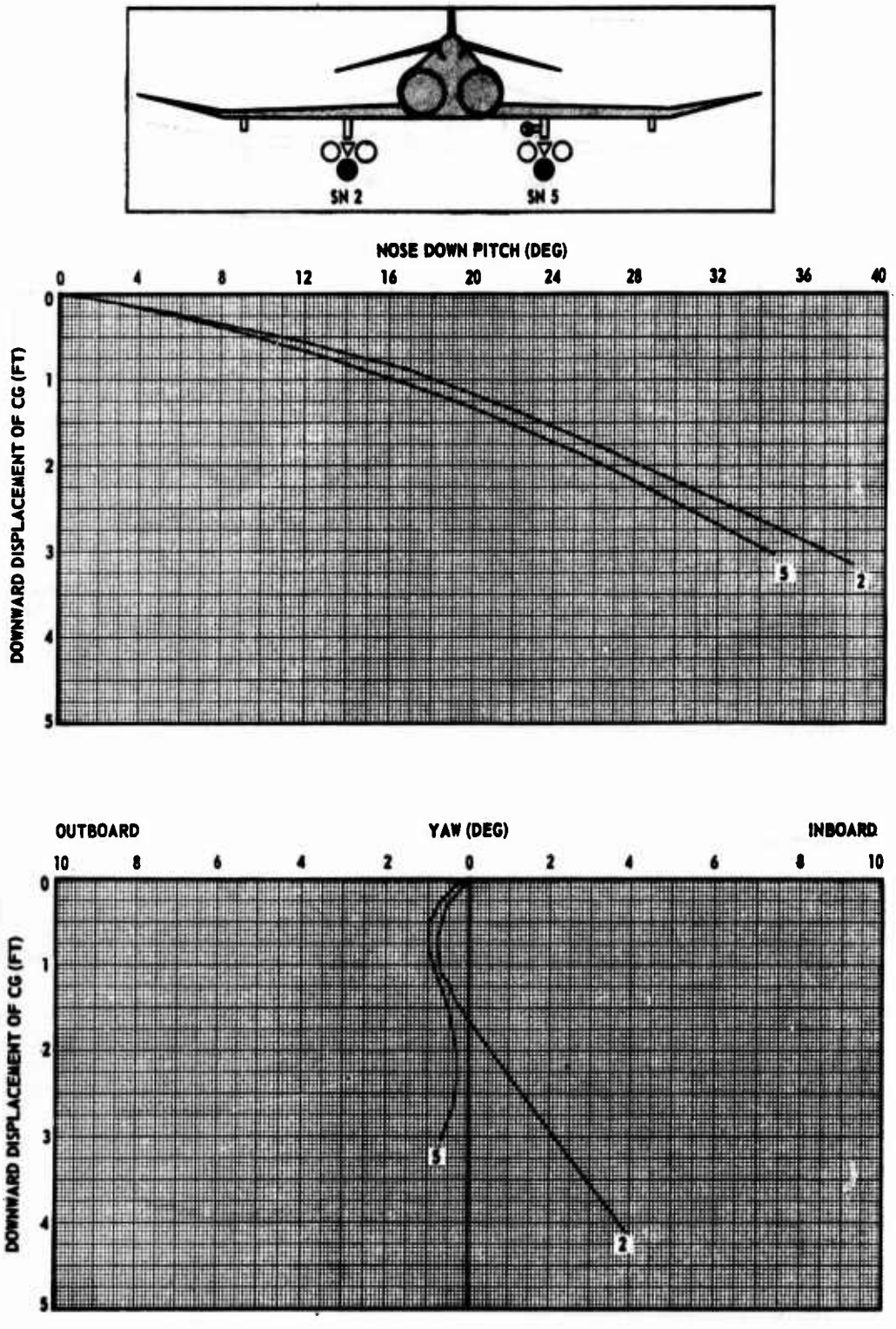
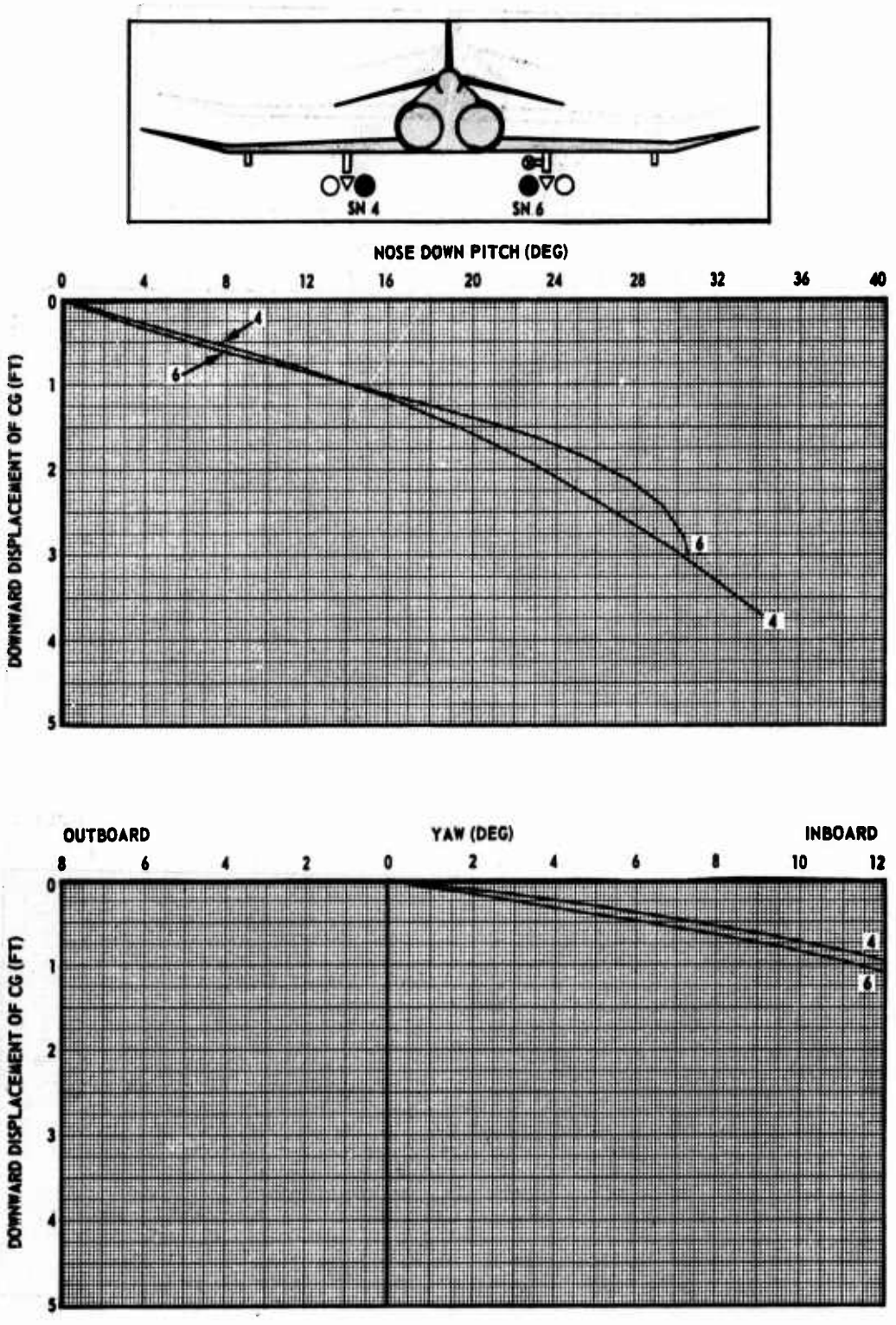


Figure I-4. Separation characteristics of CBU-67H/B at 550 KCAS



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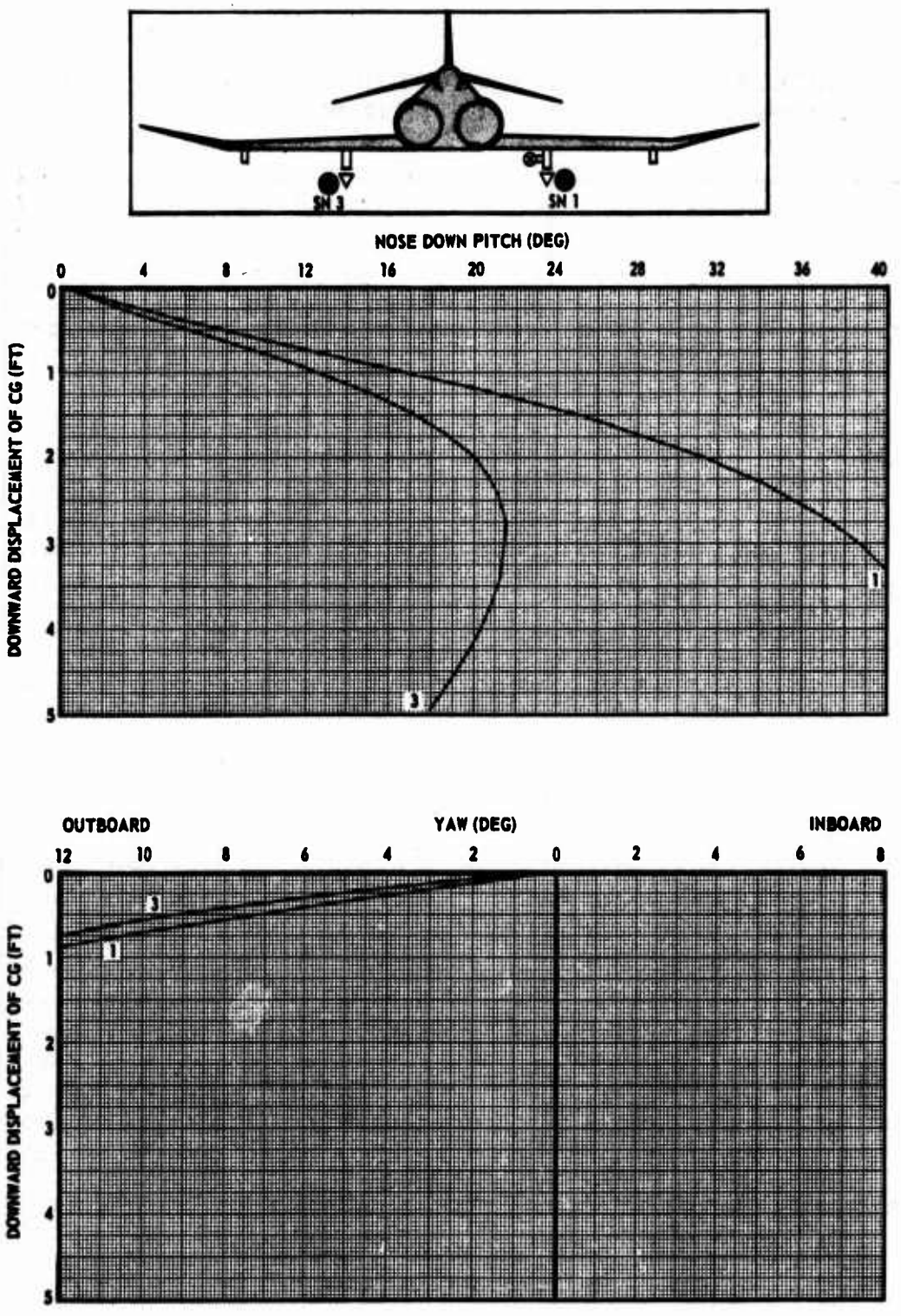

Figure I-4. (Concluded)

APPENDIX II

ACTUAL WEIGHT, CENTER OF GRAVITY, AND MOMENTS OF INERTIA OF TEST MUNITIONS

Store type	Serial number	Weight	Center of gravity (in. forward of aft lug)	Moment of inertia (ft/lb/sec^2)	
				Yaw	Pitch
MK 82 LDGP	7	515	7 3/4	36.91	36.91
	8	511	7 11/16	36.55	36.55
	9	508	7 1/4	35.84	35.84
	10	515	7 11/16	36.91	36.91
	11	509	7 5/8	36.19	36.91
	12	513	7 5/8	36.55	36.55
MK 82 SE	1	537	4 7/8	46.76	46.76
	2	571	4 15/16	49.18	49.59
	3	571	4 11/16	48.77	48.77
	4	532	5 1/8	46.76	46.76
	5	579	4 13/16	48.77	48.77
	6	571	4 7/8	48.37	48.37
CBU-67H/B	1	862	8 1/4	62.99	---
	2	843	8 9/16	60.74	---
	3	841	8 5/16	62.09	---
	4	841	8 9/16	60.74	---
	5	853	8 3/8	61.64	---
	6	844	8 3/4	59.84	---
	7	836	8 3/4	59.83	---
	8	841	8 5/8	60.73	---
	9	845	8 3/8	60.73	---
	10	844	8 3/8	61.18	---
	11	849	8 3/8	61.63	---
	12	838	8 7/8	59.39	---

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5. AUTHOR(S) (First name, middle initial, last name)

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13. ABSTRACT

This test was conducted to determine which missile-stores combinations could be carried on the same inboard pylon of the F-4 aircraft. The selected munitions for which a fit test was performed included the MK 82 low drag general purpose bomb, MK 82 Snakeye, CBU-67B/B, MK 82 laser guided bomb, MK 84 laser guided bomb, MK 84 electro-optical guided bomb, M118 laser guided bomb, and the M118 electro-optical guided bomb. Of these munitions only the MK 82 low drag general purpose bomb, the MK 82 Snakeye, and the CBU-67B/B fit when they were loaded on an inboard TER station and an AIM-4D was mounted on the inboard side of the pylon. For these three munitions, store separation testing was also accomplished (the CBU-67B/B was replaced by the CBU-67H/B for separation testing). The presence of an AIM-4D on the pylon tended to increase nose-down pitch of these munitions when compared to releases of the munitions without an AIM-4D mounted on the pylon.

DD FORM 1 NOV 65 1473

UNCLASSIFIED
Security Classification

14 KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
TER (triple ejector rack)						
MK 84						
MK 82						
M118						
CBU-67B/B						
SUU-30B/B						
KMU-351/B						
AIM-4D						
AIM-9B/E						
L-41						
L-42						
CBU-67H/B						
AERO 3-B						
KMU-370/B						
KMU-390/B						
KMU-350/B						
KMU-388/B						
SEEK EAGLE						
Compatibility						